

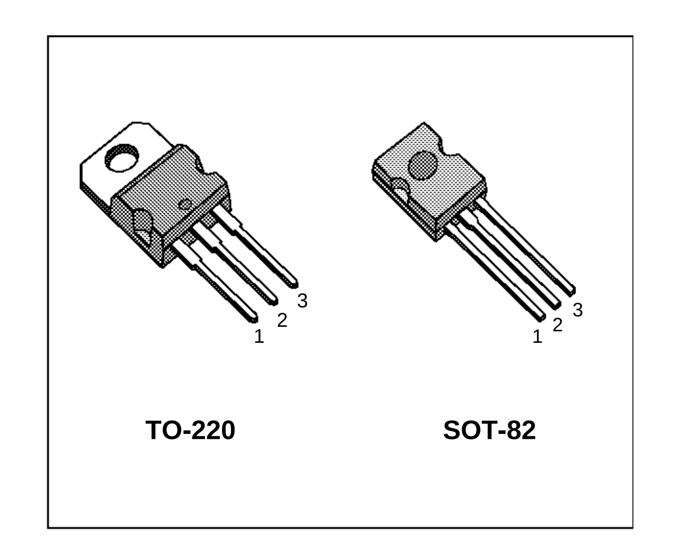
# BUL38D
# BULK38D

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- SGS-THOMSON PREFERRED SALESTYPES
- HIGH VOLTAGE CAPABILITY
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- LOW BASE-DRIVE REQUIREMENTS
- VERY HIGH SWITCHING SPEED
- FULLY CHARACTERISED AT 125°C
- HIGH RUGGEDNESS
- INTEGRATED ANTIPARALLEL COLLECTOR-EMITTER DIODE

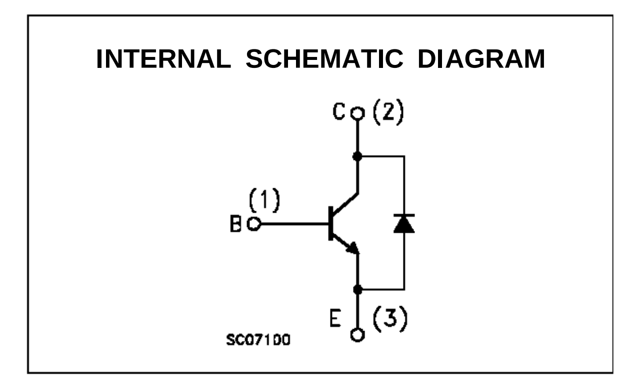
### APPLICATIONS
- ELECTRONIC TRANSFORMERS FOR HALOGEN LAMPS
- SWITCH MODE POWER SUPPLIES

### DESCRIPTION
The BUL38D and BULK38D are manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds and high voltage withstand capability.
The BUL series is designed for use in lighting applications and low cost switch-mode power supplies.



**TO-220** **SOT-82**

**INTERNAL SCHEMATIC DIAGRAM**




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | BUL38D | BULK38D | |
| $V_{CES}$ | Collector-Emitter Voltage ($V_{BE}$ = 0) | 800 | | V |
| $V_{CEO}$ | Collector-Emitter Voltage ($I_B$ = 0) | 450 | | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0) | 9 | | V |
| $I_C$ | Collector Current | 5 | | A |
| $I_{CM}$ | Collector Peak Current ($t_p$ < 5 ms) | 8 | | A |
| $I_B$ | Base Current | 2 | | A |
| $I_{BM}$ | Base Peak Current ($t_p$ < 5 ms) | 4 | | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 °C | 70 | 60 | W |
| $T_{stg}$ | Storage Temperature Range | -65 to 150 | | °C |
| $T_j$ | Max. Operating Junction Temperature | 150 | | °C |

## THERMAL DATA

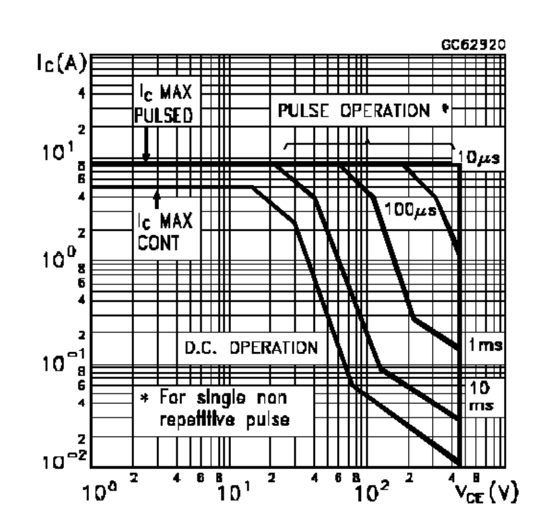
| | | TO220 | SOT-82 | |
|---|---|---|---|---|
| $R_{thj-case}$ | Thermal Resistance Junction-Case Max | 1.78 | 2.08 | °C/W |
| $R_{thj-amb}$ | Thermal Resistance Junction-Ambient Max | 62.5 | 80 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25 °C unless otherwise specified)

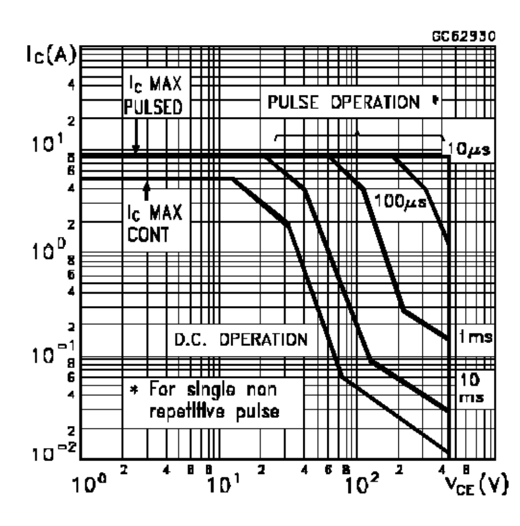
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CES}$ | Collector Cut-off Current ($V_{BE}$ = 0) | $V_{CE}$ = 800 V<br>$V_{CE}$ = 800 V $T_j$ = 125 °C | | | 100<br>500 | µA<br>µA |
| $I_{CEO}$ | Collector Cut-off Current ($I_B$ = 0) | $V_{CE}$ = 450 V | | | 250 | µA |
| $V_{CEO(sus)}$ | Collector-Emitter Sustaining Voltage | $I_C$ = 100 mA L = 25 mH | 450 | | | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0) | $I_E$ = 10 mA | 9 | | | V |
| $V_{CE(sat)}$* | Collector-Emitter Saturation Voltage | $I_C$ = 1 A $I_B$ = 0.2 A<br>$I_C$ = 2 A $I_B$ = 0.4 A<br>$I_C$ = 3 A $I_B$ = 0.75 A | | | 0.5<br>0.7<br>1.1 | V<br>V<br>V |
| $V_{BE(sat)}$* | Base-Emitter Saturation Voltage | $I_C$ = 1 A $I_B$ = 0.2 A<br>$I_C$ = 2 A $I_B$ = 0.4 A | | | 1.1<br>1.2 | V<br>V |
| $h_{FE}$* | DC Current Gain | $I_C$ = 2 A $V_{CE}$ = 5 V<br>$I_C$ = 10 mA $V_{CE}$ = 5 V | 8<br>10 | | | |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C$ = 2 A $I_{B1}$ = 0.4 A<br>$V_{BE(off)}$ = -5 V $R_{BB}$ = 0 Ω<br>$V_{CL}$ = 250 V L = 200 µH | | 1<br>55 | 1.8<br>100 | µs<br>ns |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C$ = 2 A $I_{B1}$ = 0.4 A<br>$V_{BE(off)}$ = -5 V $R_{BB}$ = 0 Ω<br>$V_{CL}$ = 250 V L = 200 µH<br>$T_j$ = 125 °C | | 1.3<br>100 | | µs<br>ns |
| $V_f$ | Diode Forward Voltage | $I_C$ = 2 A | | | 2.5 | V |

∗ Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

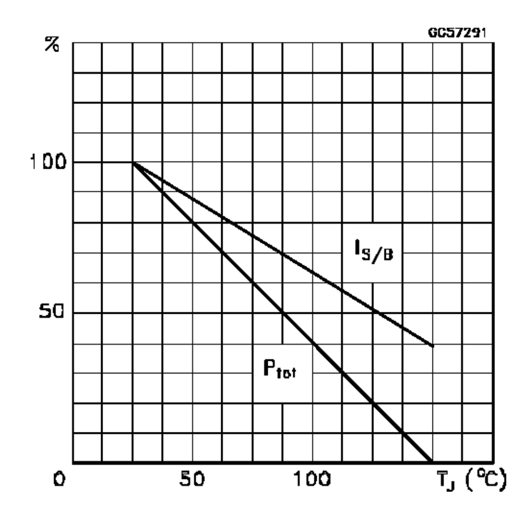
Safe Operating Areas for TO-220



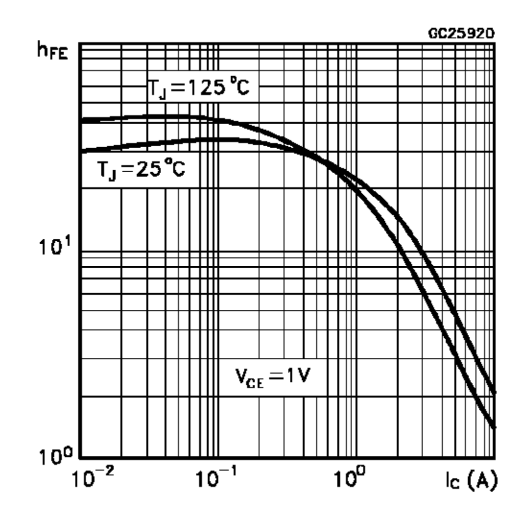

Safe Operating Areas for SOT-82



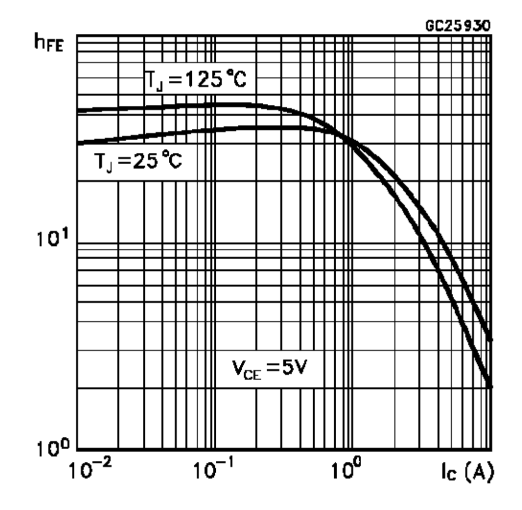
Derating Curves



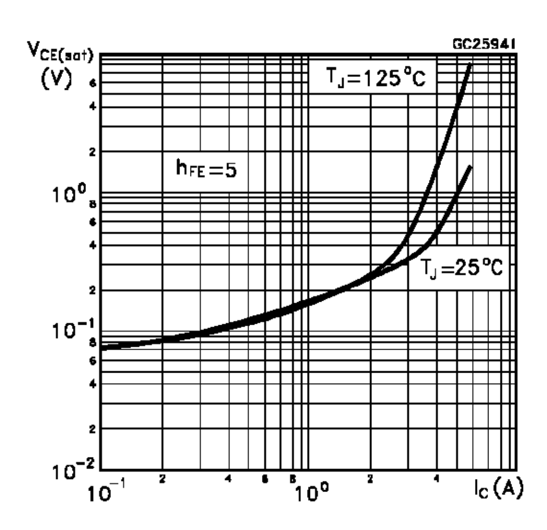

DC Current Gain



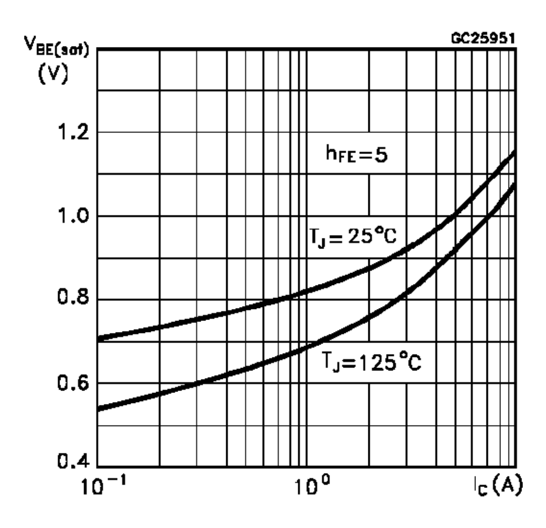

DC Current Gain



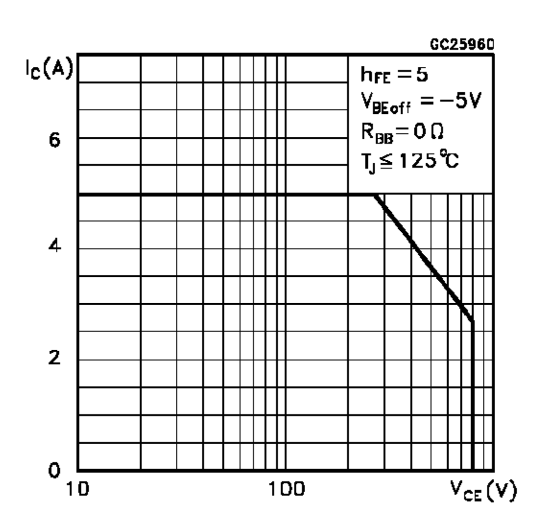

Collector Emitter Saturation Voltage




Base Emitter Saturation Voltage



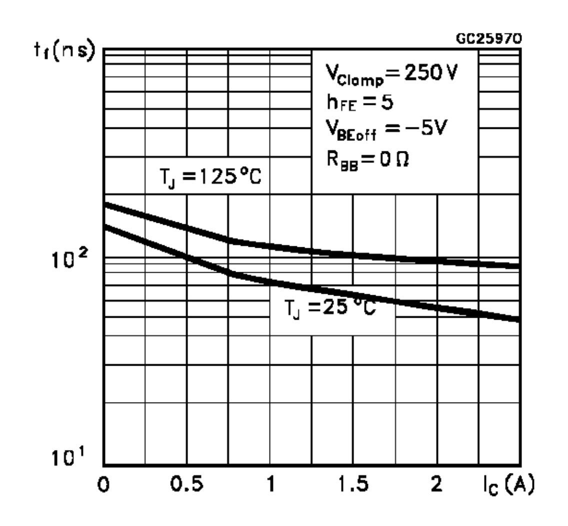

Reverse Biased SOA



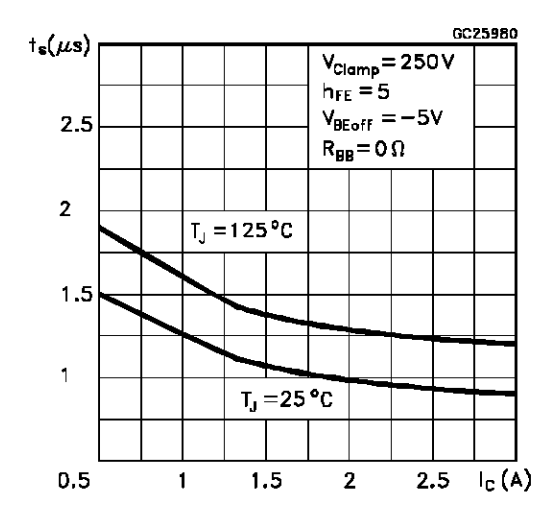




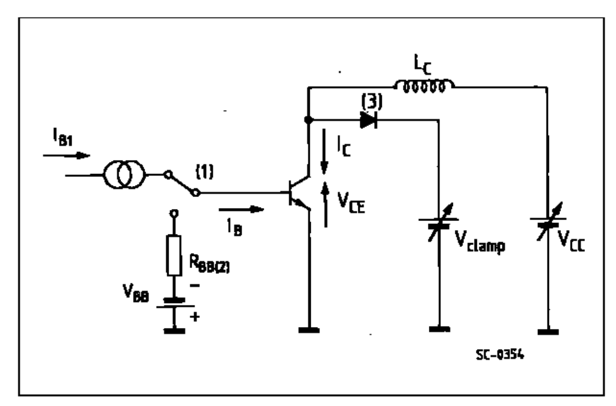

Inductive Fall Time




Inductive Storage Time



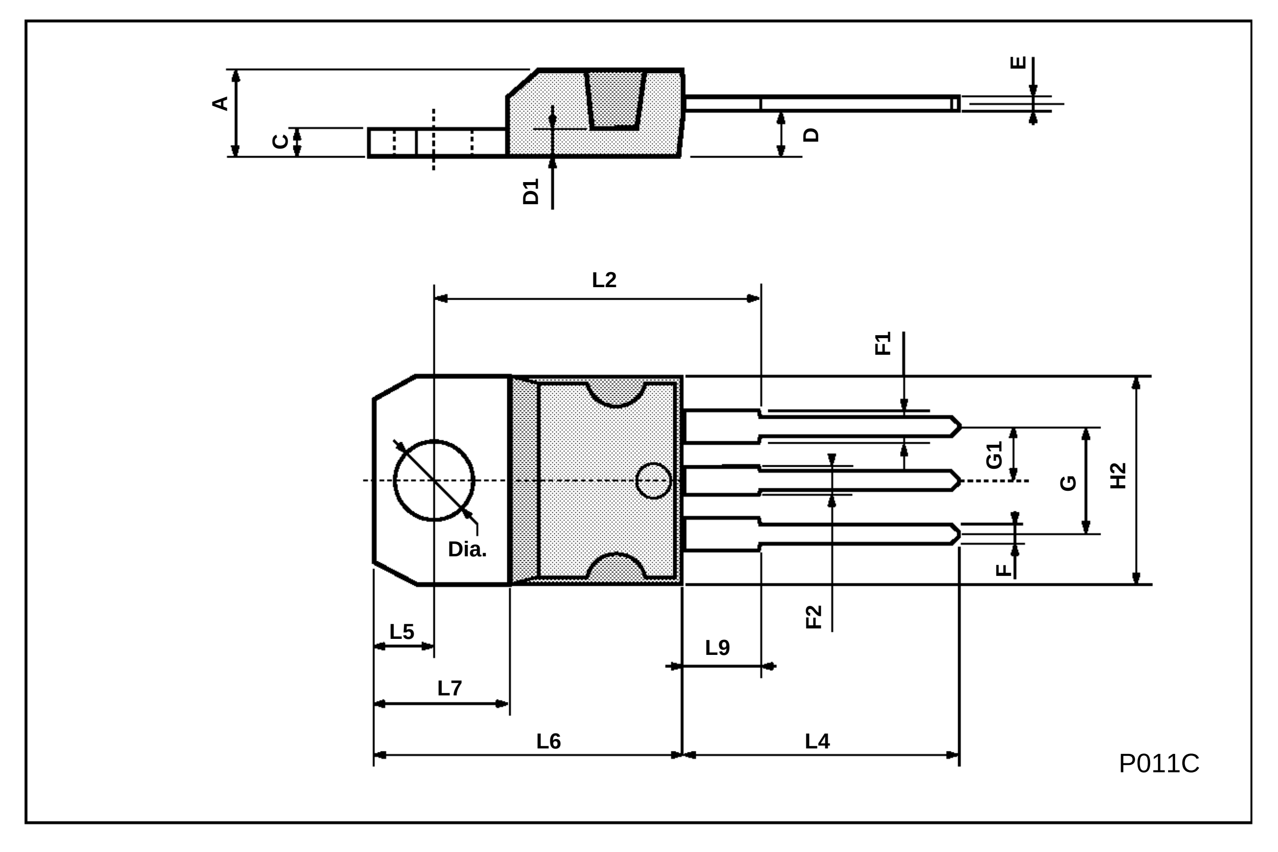

RBSOA and Inductive Load Switching Test Circuit




(1) Fast electronic switch
(2) Non-inductive Resistor
(3) Fast recovery rectifier

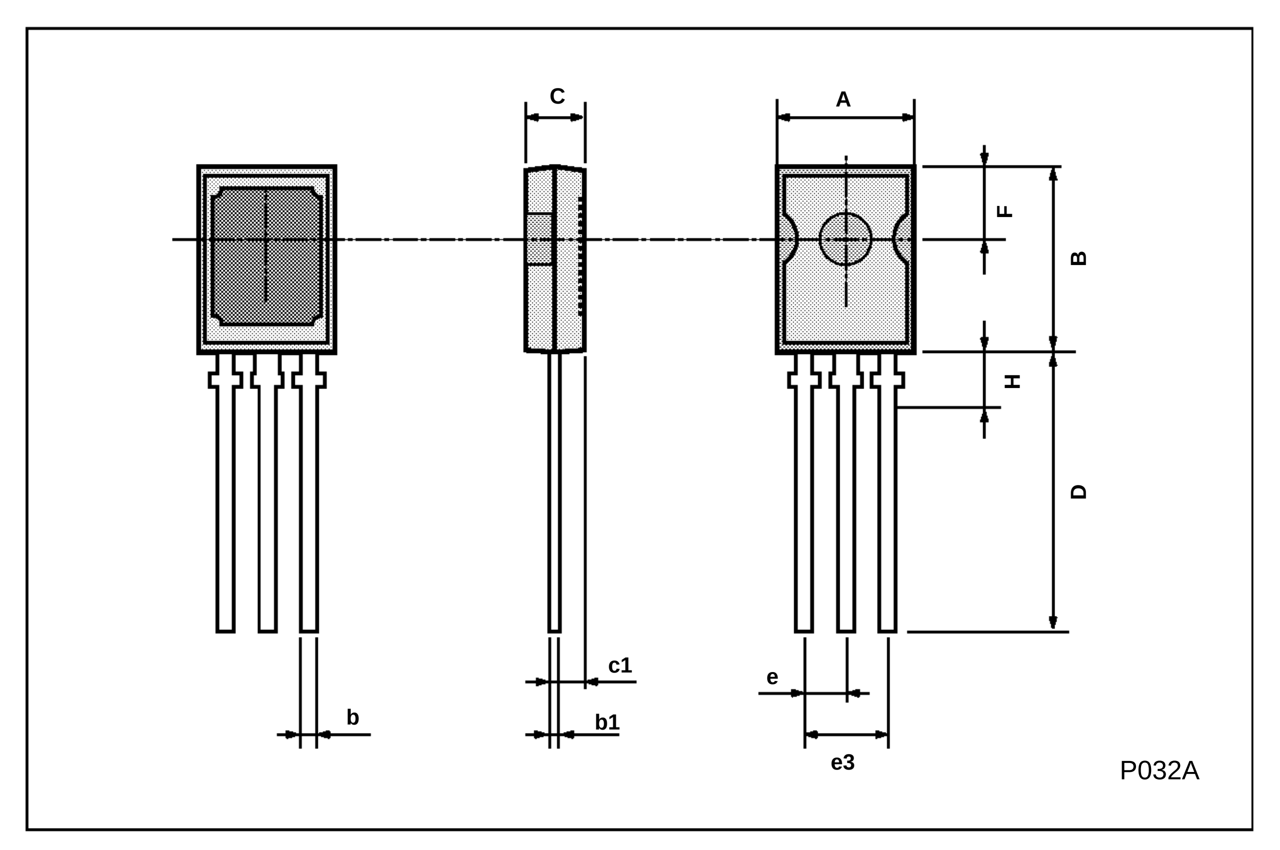
## TO-220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| L9 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |



## SOT-82 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 7.4 | | 7.8 | 0.291 | | 0.307 |
| B | 10.5 | | 11.3 | 0.413 | | 0.445 |
| b | 0.7 | | 0.9 | 0.028 | | 0.035 |
| b1 | 0.49 | | 0.75 | 0.019 | | 0.030 |
| C | 2.4 | | 2.7 | 0.04 | | 0.106 |
| c1 | | 1.2 | | | 0.047 | |
| D | | 15.7 | | | 0.618 | |
| e | | 2.2 | | | 0.087 | |
| e3 | | 4.4 | | | 0.173 | |
| F | | 3.8 | | | 0.150 | |
| H | | | 2.54 | | 0.100 | |




SGS-THOMSON
MICROELECTRONICS